

# PATENT COOPERATION TREATY

## PCT



### INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

REC'D 13 JUL 2006

WIPO PCT

Applicant's or agent's file reference BOR 33 PCT		<b>FOR FURTHER ACTION</b>		See Form PCT/PEA/416
International application No. PCT/FI2005/000153		International filing date (day/month/year) 15.03.2005	Priority date (day/month/year) 15.03.2004	
International Patent Classification (IPC) or national classification and IPC INV. B01J8/24 B01J8/44 C08F2/01				
Applicant BOREALIS TECHNOLOGY OY				
<p>1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 5 sheets, including this cover sheet.</p> <p>3. This report is also accompanied by ANNEXES, comprising:</p> <p>a. <input checked="" type="checkbox"/> sent to the applicant and to the International Bureau) a total of 3 sheets, as follows:</p> <p><input checked="" type="checkbox"/> sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).</p> <p><input type="checkbox"/> sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.</p> <p>b. <input type="checkbox"/> (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in electronic form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).</p>				
<p>4. This report contains indications relating to the following items:</p> <p><input checked="" type="checkbox"/> Box No. I Basis of the report</p> <p><input type="checkbox"/> Box No. II Priority</p> <p><input type="checkbox"/> Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</p> <p><input type="checkbox"/> Box No. IV Lack of unity of invention</p> <p><input checked="" type="checkbox"/> Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</p> <p><input type="checkbox"/> Box No. VI Certain documents cited</p> <p><input type="checkbox"/> Box No. VII Certain defects in the international application</p> <p><input type="checkbox"/> Box No. VIII Certain observations on the international application</p>				
Date of submission of the demand  13.01.2006		Date of completion of this report  13.07.2006		
Name and mailing address of the international preliminary examining authority:  European Patent Office - P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Tx: 31 651 epo nl Fax: +31 70 340 - 3016		Authorized officer Vlassis, M Telephone No. +31 70 340-4292 		

**INTERNATIONAL PRELIMINARY REPORT  
ON PATENTABILITY**

International application No.  
PCT/FI2005/000153

**Box No. I Basis of the report**

1. With regard to the **language**, this report is based on

- ☒ the international application in the language in which it was filed
- ☐ a translation of the international application into , which is the language of a translation furnished for the purposes of:
  - ☐ international search (under Rules 12.3(a) and 23.1(b))
  - ☐ publication of the international application (under Rule 12.4(a))
  - ☐ international preliminary examination (under Rules 55.2(a) and/or 55.3(a))

2. With regard to the **elements\*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report):*

**Description, Pages**

1-11 as originally filed

**Claims, Numbers**

1-13 as originally filed

**Drawings, Sheets**

1/5-5/5 as originally filed

- ☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing

3. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages
- ☐ the claims, Nos.
- ☐ the drawings, sheets/figs
- ☐ the sequence listing *(specify)*:
- ☐ any table(s) related to sequence listing *(specify)*:

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

- ☐ the description, pages
- ☐ the claims, Nos.
- ☐ the drawings, sheets/figs
- ☐ the sequence listing *(specify)*:
- ☐ any table(s) related to sequence listing *(specify)*:

\* If item 4 applies, some or all of these sheets may be marked "superseded."

**INTERNATIONAL PRELIMINARY REPORT  
ON PATENTABILITY**

International application No.  
PCT/FI2005/000153

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**Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

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1. Statement

Novelty (N)	Yes: Claims	1-12
	No: Claims	
Inventive step (IS)	Yes: Claims	1-12
	No: Claims	
Industrial applicability (IA)	Yes: Claims	1-12
	No: Claims	

2. Citations and explanations (Rule 70.7):

**see separate sheet**

**Re Item V.**

1) The amendments filed by the applicant with fax dated 19/1/2006 are considered to comply with the requirements of Art. 34(2)(b) PCT.

2) The present application meets the criteria of Article 33(1) PCT, because the subject-matter of independent claims 1 and 10 is new in the sense of Article 33(2) PCT and involves an inventive step in the sense of Article 33(3) PCT.

Document D1, is considered to represent the most relevant state of the art. D1 discloses an apparatus and method for producing polymers by gas phase polymerisation wherein a plurality of gas distribution plates fitted inside a reactor body such that an essentially annular opening is formed between the periphery of the plate edge and the reactor wall as to allow the flow of gas stream fed into the lower part of the reactor along the inside of the reactor walls past the distribution plates, are used (see fig. 3 and 4 and claims).

The difference between D1 and the subject-matter of independent claims 1 and 10 is that in D1 more than one distribution plates are fitted inside the reactor.

The subject-matter of claims 1 and 10 is therefore novel (Article 33(2) PCT).

The problem to be solved by the present invention may be regarded as providing a reactor of simpler construction in which fouling is avoided and a method wherein this reactor is used.

The solution to this problem proposed in claims 1 and 10 of the present application is considered as involving an inventive step because D1 neither discloses nor suggests the use of a single distribution plate, on the contrary it teaches away of such a solution.

3) Claims 2-9 are dependent on claim 1 and claims 11 and 12 are dependent on claim 10 and as such also meet the requirements of the PCT with respect to novelty and inventive step.

**INTERNATIONAL PRELIMINARY  
REPORT ON PATENTABILITY  
(SEPARATE SHEET)**

International application No.

PCT/FI2005/000153

**Claims:**

1. Method of producing polymers in a gas phase polymerization reactor, which has an elongated reactor body, defined by reactor walls, and an essentially vertically disposed central axis, the reactor comprising an upper part, in which a reactor bed of fluidized catalyst particles can be formed, and a lower part, in which monomer gas can be introduced, said upper and said lower parts being separated by a distribution plate, which promotes distribution into the fluidized bed of monomers flowing from the lower part into the upper part, according to which method
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- 10     – a gas stream containing monomer(s) is fed into the lower part of the reactor,  
      – the monomer(s) is (are) polymerized on the catalyst particles to form a polymer,  
      – unreacted monomers are withdrawn, and  
      – the polymer is recovered and, optionally, subjected to further treatment,
- characterized by
- 15     – conducting at least a part of the gas stream fed into the lower part of the reactor along the inside of the reactor walls past the distribution plate to prevent the formation of stagnant zones in the fluidized bed at the reactor walls in the vicinity of the distribution plate, and
- 20     – using a single distribution plate in the reactor body.
2. The method according to claim 1, wherein a gas stream is conducted along at least 80 % of the periphery of the inside of the reactor wall abutting the distribution plate.
3. The method according to claim 1 or 2, wherein a gas stream is conducted along 90 – 100
- 25 % of the periphery of the inside of the reactor wall abutting the distribution plate.
4. The method according to any of the preceding claims, wherein the gas stream is conducted along the periphery of the inside of the reactor wall through an essentially annular opening formed between the outer edge of the distribution plate and the inside of
- 30 the reactor wall.
5. The method according to claim 4, wherein the annular opening has a width of at least 1 mm, preferably 2 to 20 mm, in particular about 2 to 10 mm.

6. The method according to any of the preceding claims, wherein the flow rate of the gas stream conducted along the inside of the reactor wall is about 1 to 200 cm/s, preferably 10 to 100 cm/s, in particular 30 to 70 cm/s.

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7. The method according to any of the preceding claims, wherein the distribution plate has openings, which are not covered by overcaps to allow for free flow of gas through the openings from the lower part of the reactor into the upper part.

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8. The method according to any of the preceding claims, wherein the openings of the distribution plate are essentially circular in cross-section.

9. The method according to any of the preceding claims, wherein the part of the gas stream conducted along the inside preferably forms an essential part, typically at least

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10 %, preferably at least 30 %, in particular at least 40 %, of the total flow of gas through the plate.

10. Apparatus for producing polymers by gas phase polymerization, comprising

– an elongated reactor body, defined by reactor walls, said reactor body having an essentially vertically disposed central axis,

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○ the reactor comprising an upper part, in which a reactor bed of fluidized catalyst particles can be formed, and

○ a lower part, in which monomer gas can be introduced,

○ said upper and said lower parts being separated by a distribution plate, which promotes distribution into the fluidized bed of monomers flowing from the lower part into the upper part,

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– at least one feed nozzle in the lower part of the reactor for introducing a gas stream containing monomer(s) into the lower part of the reactor,

– an outlet nozzle in the upper part of the reactor for recovering unreacted monomer(s), and

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– a discharge device in the upper part of the reactor for recovering polymer product from the reactor,

characterized in that

- the distribution plate is fitted inside the reactor body in such a way that an essentially annular opening is formed between the periphery of the plate edge and the reactor wall to allow for the flow of gas stream fed into the lower part of the reactor along the inside of the reactor walls past the distribution plate, and
- 5      – there is a single distribution plate fitted inside the reactor body.

11. The apparatus according to claim 10, wherein reactor body has a circular cross-section transversal to the central axis and the distribution plate has a circular periphery, the diameter of the distribution plate being at least 1 mm, preferably about 2 to 20 mm, smaller  
10      than the inner diameter of the reactor body.

12. The apparatus according to claim 10 or 11, wherein the openings of the distribution plate have a circular cross-section transversally to the central axis of the reactor.